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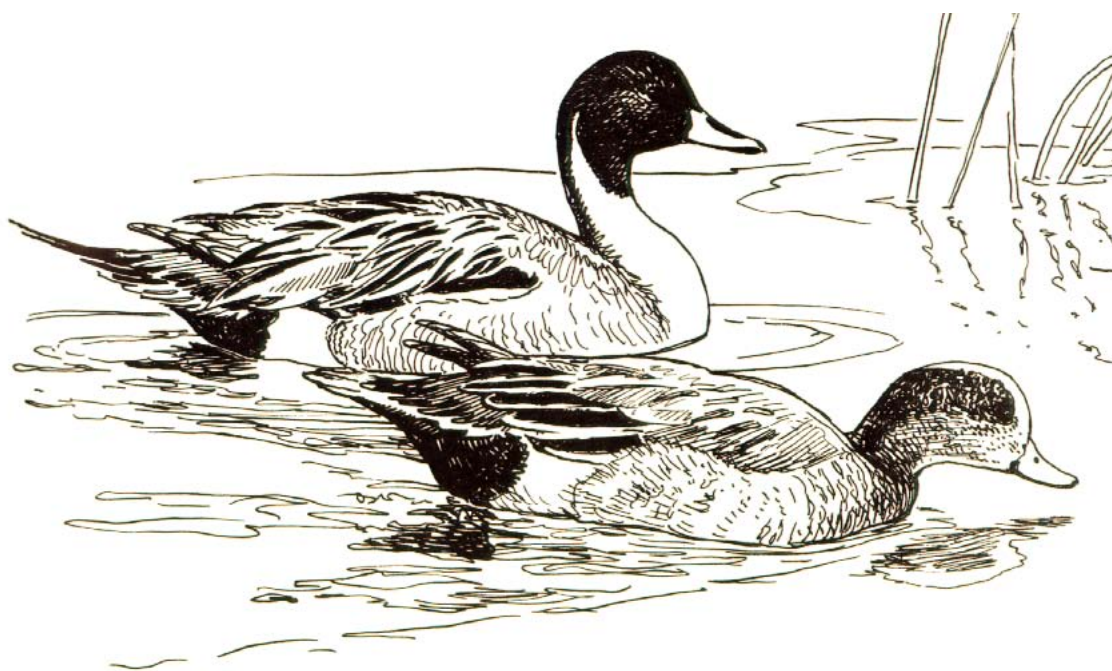
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U.S. Fish & Wildlife Service

Trends in Duck Breeding Populations 1955–2011

July 1, 2011



TRENDS IN DUCK BREEDING POPULATIONS, 1955–2011

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Administrative Report—July 1, 2011

This report summarizes information about the status of duck populations and wetland habitats during spring 2011, focusing on areas encompassed by the U.S. Fish & Wildlife (USFWS) and Canadian Wildlife Services' (CWS) Waterfowl Breeding Population and Habitat Survey. We do not include information from surveys conducted by state or provincial agencies. In the traditional survey area, which includes strata 1–18, 20–50, and 75–77 (Figure 1), the total duck population estimate (excluding scoters [*Melanitta* spp.], eiders [*Somateria* spp. and *Polysticta stelleri*], long-tailed ducks [*Clangula hyemalis*], mergansers [*Mergus* spp. and *Lophodytes cucullatus*], and wood ducks [*Aix sponsa*]) was 45.6 ± 0.8 [SE] million birds. This represents an 11% increase over last year's estimate of 40.9 ± 0.7 million, and is 35% higher than the long-term average^a (1955–2010; Table 1). The estimated mallard (*Anas platyrhynchos*) abundance was 9.2 ± 0.3 million, which was 9% above the 2010 estimate of 8.4 ± 0.3 million, and 22% above the long-term average of 7.5 ± 0.04 million (Table 2). Estimated abundance of gadwall (*A. strepera*; 3.3 ± 0.2 million) was similar to the 2010 estimate and 80% above the long-term average (1.8 ± 0.02 million; Table 3). The estimate for American wigeon (*A. americana*; 2.1 ± 0.1 million) was 14% below the 2010 estimate and 20% below the long-term average (Table 4). The estimated abundance of green-winged teal (*A. crecca*) was 2.9 ± 0.2 million, which was 17% below the 2010 estimate and 47% above the long-term average (Table 5). The estimate of blue-winged teal abundance (*A. discors*) was 8.9 ± 0.4 million, which was 41% and 91% above the 2010 estimate and the long-term average, respectively (Table 6). The estimate for northern pintails (*A. acuta*; 4.4 ± 0.3 million) was 26% above the 2010 estimate of 3.5 ± 0.2 million and similar to the long-term average (Table 7). The northern shoveler (*A. clypeata*) estimate was 4.6 ± 0.2 million which was 14% above the 2010 estimate and 98% above the long-term average (Table 8). Redhead abundance (*Aythya americana*; 1.4 ± 0.1 million) was 27% above the 2010 estimate and 106% above the long-term average (Table 9). The canvasback estimate (*A. valisineria*; 0.7 ± 0.05 million) was similar to the 2010 estimate and 21% above the long-term average (Table 10). Estimated abundance of scaup (*A. affinis* and *A. marila* combined; 4.3 ± 0.3 million) was similar to that of 2010 and 15% below the long-term average of 5.1 ± 0.05 million (Table 11).

Habitat conditions during the 2011 Waterfowl Breeding Population and Habitat Survey were characterized by average to above-average moisture and a normal winter and spring across the entire

^aPopulations are considered to have changed from the previous year or long-term average if the observed significance value associated with change is ≤ 0.10 . Actual *P*-values are presented in tables.

traditional and eastern survey areas (Figure 3). The exception was a portion of the west-central traditional survey area that had received below-average moisture. The total pond estimate (Prairie Canada and U.S. combined) was 8.1 ± 0.2 million (Table 12, Figure 2). This was 22% above the 2010 estimate of 6.7 ± 0.2 million ponds, and 62% above the long-term average of 5.0 ± 0.03 million ponds.

Conditions across the Canadian prairies were greatly improved relative to last year. Building on excellent conditions from 2010 in portions of southern Alberta, Saskatchewan and Manitoba, the area of excellent conditions in the prairies expanded in 2011, including a region along the Alberta and Saskatchewan border that had been poor for the last two years (Figure 3 and 4). The 2011 estimate of ponds in Prairie Canada was 4.9 ± 0.2 million. This was 31% above last year's estimate (3.7 ± 0.2 million) and 43% above the 1961–2010 average (3.4 ± 0.03 million). As expected, residual water from summer 2010 precipitation remained in the parklands and the majority of the area was classified as good. Fair to poor conditions, however, were observed in the parklands of Alberta.

Wetland numbers and conditions were excellent in the U.S. prairies. The 2011 pond estimate for the north-central U.S. was 3.2 ± 0.1 million, which was similar to last year's estimate (2.9 ± 0.1 million) and 102% above the 1974–2010 average (1.6 ± 0.02 million). The eastern U.S. prairies benefited from abundant moisture in 2010 and the entire U.S. prairies experienced above-average winter and spring precipitation in 2010 and 2011, resulting in good to excellent conditions across nearly the entire region. The western Dakotas and eastern Montana were extremely dry in 2010. However, conditions there improved from fair to poor in 2010 to good to excellent in 2011. Further, the abundant moisture and delayed farming operations in the north-central U.S. and southern Canadian prairies likely benefited early-nesting waterfowl.

In the bush regions of the traditional survey area (Northwest Territories, northern Manitoba, northern Saskatchewan, and western Ontario), spring breakup was late in 2011. However, a period of warm, fair weather just prior to the survey greatly accelerated ice-out. Habitats improved from 2010 across most of northern Saskatchewan and Manitoba as a result of average to above-average summer and fall precipitation in 2010. Habitat conditions in the Northwest Territories and Alaska were classified as good in 2011. Dry conditions in the boreal forest of Alberta in 2010 persisted into 2011 as habitat conditions were again rated as fair to poor. The dry conditions in this region contributed to numerous forest fires during the 2011 survey.

In the eastern survey area, winter temperatures were above average and precipitation was below average over most of the region, with the exception of the Maritimes and Maine, which had colder than normal temperatures and above-average precipitation. Despite regional differences in winter conditions, above-average spring precipitation recharged deficient wetlands, subsequently providing good to excellent production habitat across the region. The boreal forest and Canadian Maritimes of the eastern survey area continued to have good to excellent habitat conditions in 2011. Habitat conditions in Ontario and southern Quebec improved from poor to fair in 2010 to good to excellent. Northern sections of the eastern survey area continued to remain in good to excellent conditions in 2011.

In 2005, the USFWS and CWS began to integrate data from two previously independent waterfowl surveys conducted in eastern North America into a single composite estimate using hierarchical models. Consequently, total indicated bird definitions for American black ducks (*Anas rubripes*) were modified to provide a common index across surveys, and adjustments were made to the geographic stratification of the eastern survey area. Additional refinements to analytical methods are incorporated in the estimates presented in this report. For these reasons, population estimates presented in this report for the eastern survey area (strata 51–72; Table 13) are not directly comparable with estimates presented in reports issued prior to 2006. Specifically, estimates are presented for only a portion of the eastern survey area and include data from strata 51, 52, 63, 64, 66–68, and 70–72. These 10 strata were chosen for presentation because at least one survey (i.e., either

the CWS or USFWS survey) was conducted for each of these strata for the full period of record of the eastern survey (1990–2011). In cases where the USFWS has traditionally not recorded observations to the species level, composite estimates are provided only for multiple-species groupings (i.e., mergansers, goldeneyes [*Bucephala clangula* and *B. islandica*]). The CWS and USFWS agreed to use a hierarchical modeling approach for all species in the east. Currently, the models perform well for the six most common species. In previous years, we used design-based estimates and an overall mean weighted by precision to derive integrated annual population indices for American wigeon, scaup, bufflehead (*Bucephala albeola*), and scoters until the hierarchical models could adequately analyze the data for these species. Due to concerns about (1) the appropriateness of weighting estimates from these surveys by their precision, and (2) whether estimates for some species should be integrated given the data quality and coverage in the eastern survey, we have discontinued deriving these estimates. Nonetheless, the USFWS will continue to explore methods for deriving integrated estimates for some of the less common species in the eastern survey area. Analytical methods applied to eastern survey area data and results will be presented in greater detail in the 2011 Waterfowl Status Report. We anticipate additional refinements to composite estimates for the eastern survey area in the coming years as the USFWS and CWS work toward a final integrated survey design and analytical approach.

Estimated abundance of mallards in the eastern survey area was 0.4 ± 0.1 million, which was similar to the 2010 estimate and the long-term average. The estimated abundance of American black ducks was 0.5 ± 0.04 million, which was similar to the 2010 estimate and 13% below the long-term average of 0.63 million. Abundance estimates for goldeneyes, green-winged teal, and mergansers were similar to last year’s estimates and their 1990–2010 averages (Table 13, Figure 6, Appendix B).

The data in this report were contributed by the following individuals:

Alaska, Yukon Territory, and Old Crow Flats (Strata 1–12)

Air E. Mallek and D. Groves

Northern Alberta, Northeastern British Columbia, and Northwest Territories (Strata 13–18, 20, and 77)

Air F. Roetker and C. Spiegel

Northern Saskatchewan and Northern Manitoba (Strata 21–25)

Air W. Rhodes and M. Rabe^b

Southern and Central Alberta (Strata 26–29, 75, and 76)

Air J. Bredy and K. Doherty

Ground S. Leach^d, J. Caswell^b, M. Gillespie^c, J. Ingram^a, A. Sorensen^a, M. Watmough^a,
S. Molenkamp^a, G. Raven^a, R. Wiacek^a, and E. Ewald^a

Southern Saskatchewan (Strata 30–33, 36)

Air P. Thorpe and P. Devers

Ground J.-M. DeVink^a, K. Dufour^a, K. Warner^a, N. Tchir^a, C. Holderness^a, D. Routhier^c,
P. Bergen^c, N. Wiebe^c, and N. Astleford^c

Southern Manitoba (Strata 34–35, 37–40)

Air K. Bollinger and R. Spangler

Ground M. Schuster^a, J. Leafloor^a, G. Ball^a, J. Asmundson^a, J. Black^a, R. Buss^a, and
D. Walker^a

Montana and Western Dakotas (Strata 41–44)

Air S. Bayless and J. Klimstra

Ground K. Kruse and G. Suleiman

Eastern Dakotas (Strata 45–49)

Air T. Liddick and D. Fronczak

Ground P. Garrettson, C. Nicolai, D. Collins, M. Rheude, and J. White^d

Western Ontario and Central Quebec (Strata 50, 69–70)

Air J. Wortham and G. Boomer

Helicopter G. Zimmerman and S. Gibbs

Central and Eastern Ontario (Strata 51–52, 54, 57)

Air S. Earsom and C. Ferguson^e

Southern Ontario and Southern Quebec (Strata 53, 56, and 68)

Air J. Rayfield and T. Lewis

Maine and Maritimes (Strata 62–67)

Air M. Koneff and J. Bidwell^e

Canadian Wildlife Service helicopter plot survey

Quebec D. Bordage^a, C. Lepage^a, C. Marcotte^a, and S. Orichefsky^a

Ontario S. Meyer^a, C. Sharp^a, R. Russell^a, and R. Coe^d

New Brunswick &

Nova Scotia R. Hicks^a, B. Pollard^a, A. Hicks^a

Labrador &

Newfoundland S. Gilliland^a, P. Ryan^a, R. Wells^a, and P. MacDonald^a

^aCanadian Wildlife Service

^bState, Provincial or Tribal Conservation Agency

^cDucks Unlimited Canada

^dOther Organization

^eU.S. Fish & Wildlife Service Retired

All others—U.S. Fish & Wildlife Service

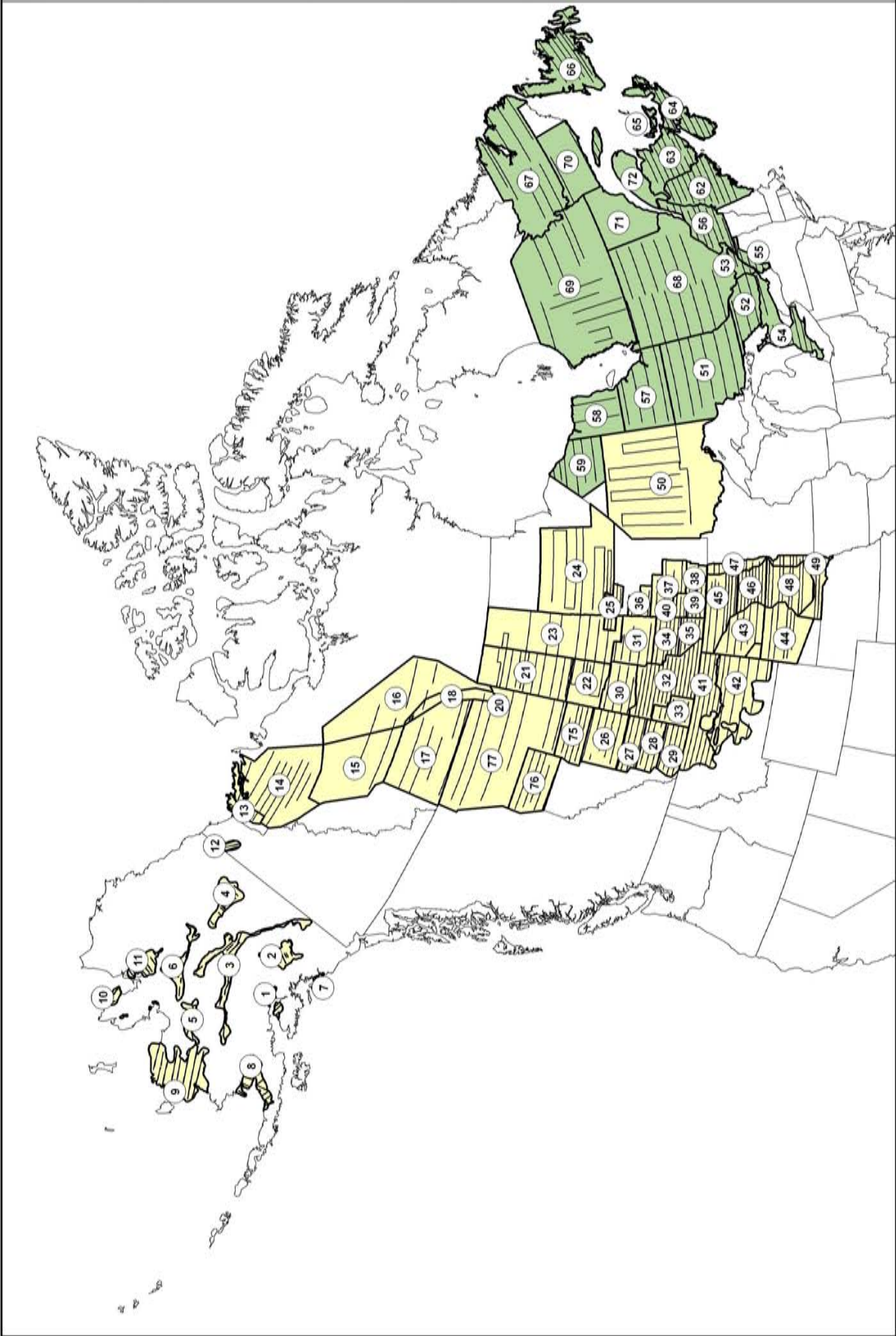


Figure 1: Strata and transects of the Waterfowl Breeding Population and Habitat Survey (yellow = traditional survey area, green = eastern survey area).

Table 1: Total duck^a breeding population estimates (in thousands) for regions in the traditional survey area.

Region	2011	2010	Change from 2010		LTA ^b	Change from LTA	
			%	P		%	P
Alaska–Yukon							
Territory–Old Crow Flats	3,756	5,556	-32	<0.001	3,688	+2	0.660
C. & N. Alberta–N.E. British Columbia–NWT	7,095	8,717	-19	0.001	7,119	0	0.942
N. Saskatchewan							
–N. Manitoba–W. Ontario	2,439	2,149	+13	0.189	3,509	-30	<0.001
S. Alberta	4,372	2,641	+66	<0.001	4,240	+3	0.472
S. Saskatchewan	10,681	6,839	+56	<0.001	7,495	+43	<0.001
S. Manitoba	1,554	1,104	+41	<0.001	1,528	+2	0.754
Montana & Western Dakotas	3,135	1,977	+59	<0.001	1,632	+92	<0.001
Eastern Dakotas	12,523	11,910	+5	0.365	4,598	+172	<0.001
Total	45,554	40,894	+11	<0.001	33,809	+35	<0.001

^a Includes 10 species in Appendix A plus American black duck, ring-necked duck, goldeneyes, bufflehead, and ruddy duck (*Oxyura jamaicensis*); excludes eiders, long-tailed duck, scoters, mergansers, and wood duck.

^b Long-term average, 1955–2010.

Table 2: Mallard breeding population estimates (in thousands) for regions in the traditional survey area.

Region	2011	2010	Change from 2010		LTA ^a	Change from LTA	
			%	P		%	P
Alaska–Yukon							
Territory–Old Crow Flats	416	606	-31	0.004	374	+11	0.289
C. & N. Alberta–N.E. British Columbia–NWT	975	1,423	-31	0.004	1,078	-10	0.249
N. Saskatchewan							
–N. Manitoba–W. Ontario	828	801	+3	0.851	1,132	-27	0.001
S. Alberta	939	598	+57	<0.001	1,071	-12	0.042
S. Saskatchewan	2,093	1,699	+23	0.023	2,056	+2	0.785
S. Manitoba	521	351	+49	0.006	381	+37	0.009
Montana & Western Dakotas	837	533	+57	<0.001	501	+67	<0.001
Eastern Dakotas	2,574	2,420	+6	0.519	952	+170	<0.001
Total	9,183	8,430	+9	0.054	7,545	+22	<0.001

^a Long-term average, 1955–2010.

Table 3: Gadwall breeding population estimates (in thousands) for regions in the traditional survey area.

Region	2011	2010	Change from 2010		LTA ^a	Change from LTA	
			%	<i>P</i>		%	<i>P</i>
Alaska–Yukon							
Territory–Old Crow Flats	1	3	-54	0.454	2	-32	0.646
C. & N. Alberta–N.E. British							
Columbia–NWT	41	51	-20	0.656	51	-20	0.284
N. Saskatchewan							
–N. Manitoba–W. Ontario	33	14	+128	0.009	26	+25	0.274
S. Alberta	347	323	+7	0.693	316	+10	0.506
S. Saskatchewan	1,020	913	+12	0.445	604	+69	<0.001
S. Manitoba	92	102	-9	0.680	71	+30	0.176
Montana & Western Dakotas	470	392	+20	0.444	201	+133	<0.001
Eastern Dakotas	1,253	1,178	+6	0.668	536	+134	<0.001
Total	3,257	2,977	+9	0.271	1,808	+80	<0.001

^a Long-term average, 1955–2010.

Table 4: American wigeon breeding population estimates (in thousands) for regions in the traditional survey area.

Region	2011	2010	Change from 2010		LTA ^a	Change from LTA	
			%	<i>P</i>		%	<i>P</i>
Alaska–Yukon							
Territory–Old Crow Flats	621	1,053	-41	<0.001	550	+13	0.173
C. & N. Alberta–N.E. British							
Columbia–NWT	650	597	+9	0.607	895	-27	0.001
N. Saskatchewan							
–N. Manitoba–W. Ontario	126	73	+72	0.078	240	-48	<0.001
S. Alberta	200	124	+61	0.036	284	-30	0.010
S. Saskatchewan	281	193	+46	0.063	412	-32	0.002
S. Manitoba	5	11	-56	0.062	57	-92	<0.001
Montana & Western Dakotas	92	166	-45	0.031	111	-17	0.396
Eastern Dakotas	109	206	-47	0.019	53	+104	0.001
Total	2,084	2,425	-14	0.047	2,604	-20	<0.001

^a Long-term average, 1955–2010.

Table 5: Green-winged teal breeding population estimates (in thousands) for regions in the traditional survey area.

Region	2011	2010	Change from 2010		LTA ^a	Change from LTA	
			%	<i>P</i>		%	<i>P</i>
Alaska–Yukon							
Territory–Old Crow Flats	641	954	-33	0.004	395	+62	<0.001
C. & N. Alberta–N.E. British							
Columbia–NWT	1,251	1,464	-15	0.293	781	+60	0.001
N. Saskatchewan							
–N. Manitoba–W. Ontario	126	105	+20	0.368	205	-38	<0.001
S. Alberta	275	130	+112	0.015	195	+41	0.134
S. Saskatchewan	422	398	+6	0.780	254	+66	0.004
S. Manitoba	55	48	+14	0.620	51	+8	0.729
Montana & Western Dakotas	19	39	-51	0.080	42	-55	0.002
Eastern Dakotas	110	337	-67	0.007	52	+114	0.027
Total	2,900	3,476	-17	0.032	1,975	+47	<0.001

^a Long-term average, 1955–2010.

Table 6: Blue-winged teal breeding population estimates (in thousands) for regions in the traditional survey area.

Region	2011	2010	Change from 2010		LTA ^a	Change from LTA	
			%	<i>P</i>		%	<i>P</i>
Alaska–Yukon							
Territory–Old Crow Flats	1	4	-63	0.569	1	-2	0.982
C. & N. Alberta–N.E. British							
Columbia–NWT	144	279	-48	0.047	275	-48	0.008
N. Saskatchewan							
–N. Manitoba–W. Ontario	31	5	+576	0.041	249	-88	<0.001
S. Alberta	470	294	+60	0.004	610	-23	0.014
S. Saskatchewan	2,489	1,363	+83	<0.001	1,288	+93	<0.001
S. Manitoba	393	212	+85	0.002	374	+5	0.716
Montana & Western Dakotas	894	308	+191	<0.001	267	+235	<0.001
Eastern Dakotas	4,526	3,865	+17	0.159	1,622	+179	<0.001
Total	8,948	6,329	+41	<0.001	4,687	+91	<0.001

^a Long-term average, 1955–2010.

Table 7: Northern pintail breeding population estimates (in thousands) for regions in the traditional survey area.

Region	2011	2010	Change from 2010		LTA ^a	Change from LTA	
			%	P		%	P
Alaska–Yukon							
Territory–Old Crow Flats	746	1,164	-36	0.003	930	-20	0.027
C. & N. Alberta–N.E. British							
Columbia–NWT	121	338	-64	0.004	367	-67	<0.001
N. Saskatchewan							
–N. Manitoba–W. Ontario	10	6	+77	0.336	38	-74	<0.001
S. Alberta	655	242	+171	<0.001	685	-4	0.736
S. Saskatchewan	1,106	332	+233	<0.001	1,166	-5	0.579
S. Manitoba	38	18	+109	0.015	105	-63	<0.001
Montana & Western Dakotas	279	177	+58	0.108	263	+6	0.772
Eastern Dakotas	1,473	1,233	+20	0.349	477	+209	<0.001
Total	4,429	3,509	+26	0.008	4,031	+10	0.142

^a Long-term average, 1955–2010.

Table 8: Northern shoveler breeding population estimates (in thousands) for regions in the traditional survey area.

Region	2011	2010	Change from 2010		LTA ^a	Change from LTA	
			%	P		%	P
Alaska–Yukon							
Territory–Old Crow Flats	322	626	-49	<0.001	288	+12	0.311
C. & N. Alberta–N.E. British							
Columbia–NWT	133	297	-55	0.004	220	-40	0.007
N. Saskatchewan							
–N. Manitoba–W. Ontario	7	4	+88	0.291	41	-83	<0.001
S. Alberta	878	475	+85	<0.001	387	+127	<0.001
S. Saskatchewan	1,496	795	+88	<0.001	699	+114	<0.001
S. Manitoba	148	87	+71	0.002	109	+37	0.007
Montana & Western Dakotas	430	221	+95	0.026	156	+176	0.002
Eastern Dakotas	1,227	1,553	-21	0.151	443	+177	<0.001
Total	4,641	4,057	+14	0.056	2,343	+98	<0.001

^a Long-term average, 1955–2010.

Table 9: Redhead breeding population estimates (in thousands) for regions in the traditional survey area.

Region	2011	2010	Change from 2010		LTA ^a	Change from LTA	
			%	P		%	P
Alaska–Yukon							
Territory–Old Crow Flats	1	1	-40	0.692	2	-46	0.440
C. & N. Alberta–N.E. British							
Columbia–NWT	15	51	-71	0.030	40	-63	<0.001
N. Saskatchewan							
–N. Manitoba–W. Ontario	17	3	+390	0.017	26	-37	0.080
S. Alberta	167	90	+85	0.027	122	+37	0.148
S. Saskatchewan	438	316	+38	0.129	206	+113	<0.001
S. Manitoba	65	107	-39	0.355	73	-11	0.664
Montana & Western Dakotas	40	50	-21	0.597	10	+279	0.005
Eastern Dakotas	614	444	+38	0.178	180	+241	<0.001
Total	1,356	1,064	+27	0.072	659	+106	<0.001

^a Long-term average, 1955–2010.

Table 10: Canvasback breeding population estimates (in thousands) for regions in the traditional survey area.

Region	2011	2010	Change from 2010		LTA ^a	Change from LTA	
			%	P		%	P
Alaska–Yukon							
Territory–Old Crow Flats	22	57	-60	0.040	89	-75	<0.001
C. & N. Alberta–N.E. British							
Columbia–NWT	51	72	-29	0.322	75	-32	0.042
N. Saskatchewan							
–N. Manitoba–W. Ontario	31	18	+67	0.173	53	-42	0.008
S. Alberta	33	39	-15	0.510	65	-49	<0.001
S. Saskatchewan	335	192	+74	0.002	188	+78	<0.001
S. Manitoba	68	35	+95	0.002	56	+21	0.188
Montana & Western Dakotas	17	41	-59	0.057	9	+90	0.303
Eastern Dakotas	135	131	+3	0.921	36	+278	<0.001
Total	692	585	+18	0.121	571	+21	0.010

^a Long-term average, 1955–2010.

Table 11: Scaup (greater and lesser combined) breeding population estimates (in thousands) for regions in the traditional survey area.

Region	2011	2010	Change from 2010		LTA ^a	Change from LTA	
			%	<i>P</i>		%	<i>P</i>
Alaska–Yukon							
Territory–Old Crow Flats	847	947	-11	0.418	921	-8	0.389
C. & N. Alberta–N.E. British							
Columbia–NWT	2,165	2,378	-9	0.497	2,538	-15	0.107
N. Saskatchewan							
–N. Manitoba–W. Ontario	367	208	+76	0.005	568	-35	<0.001
S. Alberta	228	127	+80	0.102	339	-33	0.045
S. Saskatchewan	347	246	+41	0.129	406	-15	0.232
S. Manitoba	85	53	+61	0.116	129	-34	0.012
Montana & Western Dakotas	38	14	+160	0.004	50	-26	0.090
Eastern Dakotas	242	271	-11	0.657	106	+128	0.001
Total	4,319	4,244	+2	0.835	5,058	-15	0.005

^a Long-term average, 1955–2010.

Table 12: Estimated number (in thousands) of May ponds in portions of Prairie and Parkland Canada and the north-central U.S.

Region	2011	2010	Change from 2010		LTA ^a	Change from LTA	
			%	P		%	P
Prairie Canada							
S. Alberta	1,086	678	+60	<0.001	739	+47	<0.001
S. Saskatchewan	3,151	2,668	+18	0.064	2,011	+57	<0.001
S. Manitoba	656	382	+72	<0.001	670	-2	0.750
Subtotal	4,893	3,729	+31	<0.001	3,419	+43	<0.001
North-central U.S.							
Montana & Western Dakotas	969	595	+63	<0.001	552	+76	<0.001
Eastern Dakotas	2,271	2,341	-3	0.682	1,056	+115	<0.001
Subtotal	3,239	2,936	+10	0.112	1,608	+102	<0.001
Total	8,132	6,665	+22	<0.001	5,005	+62	<0.001

^a Long-term average. Prairie and Parkland Canada, 1961–2010; north-central U.S. and Total, 1974–2010.

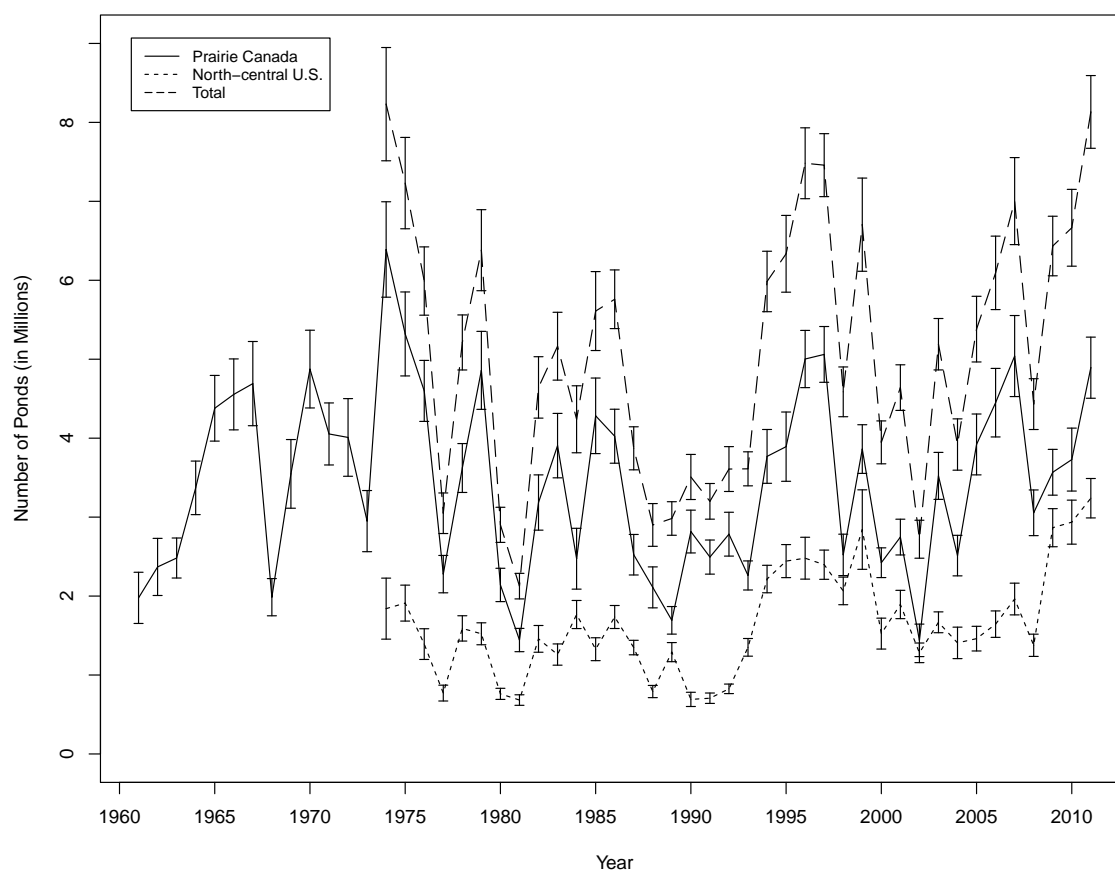


Figure 2: Number of ponds in May and 90% confidence intervals in Prairie Canada and the north-central U.S.

Table 13: Duck breeding population estimates^a (in thousands) for 6 most abundant species in the eastern survey area.

Species	2011	2010	% Change from 2010	Average ^b	% Change from average
Mallard	427	378	+13	397	+8
American black duck	545	566	-4	627	-13 ^c
Green-winged teal	256	273	-6	258	-1
Ring-necked duck	484	515	-6	489	-1
Goldeneyes (common and Barrow's)	399	395	+1	415	-4
Mergansers (common, red-breasted, and hooded)	401	377	+7	436	-8

^a Estimates from Bayesian hierarchical analysis using FWS and CWS data from strata 51, 52, 63, 64, 66–68, 70–72.

^b Average for 1990–2010.

^c Indicates significant change. Significance determined by non-overlap of Bayesian credibility intervals or confidence intervals.

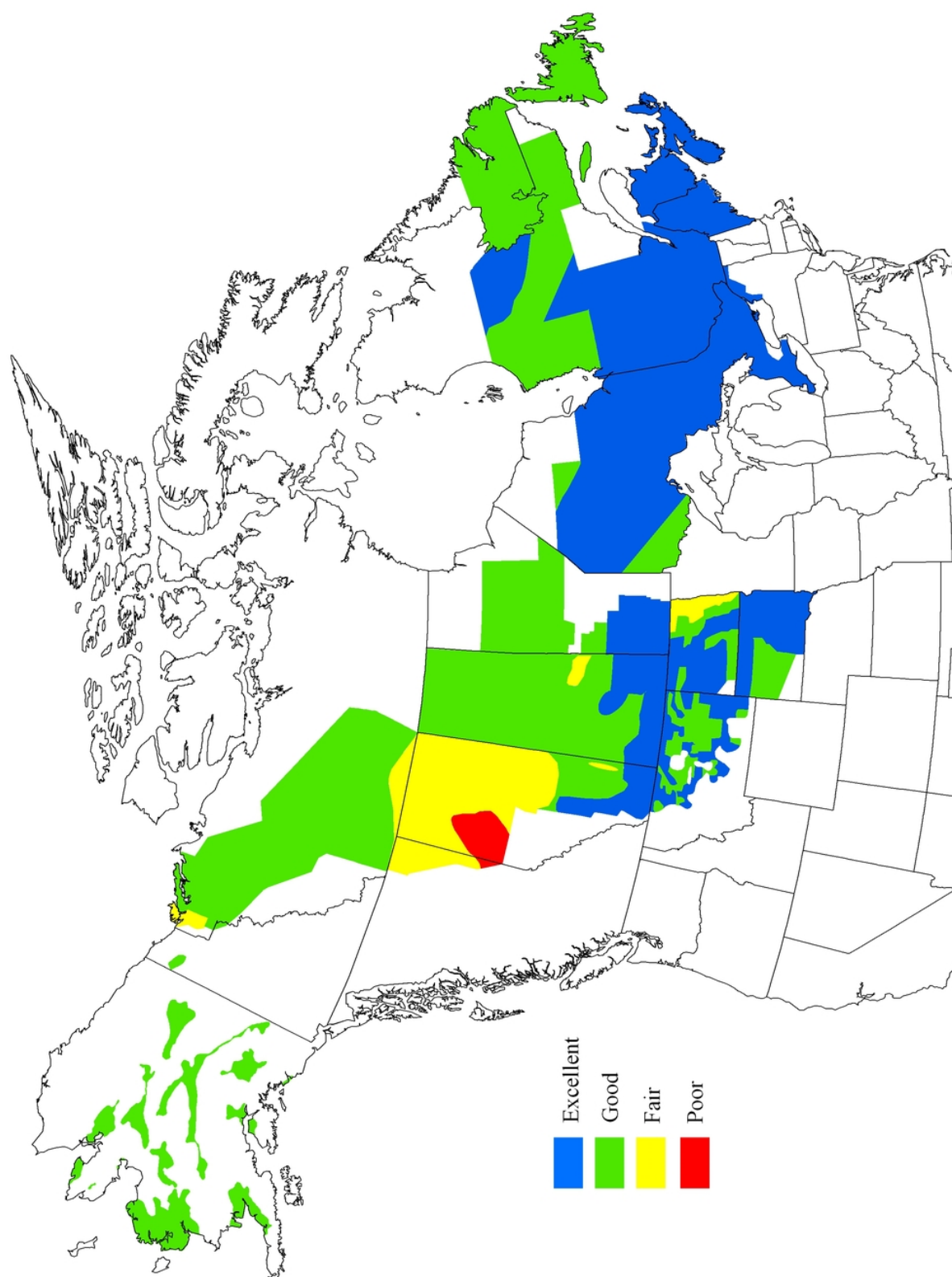


Figure 3: Breeding waterfowl habitat conditions during the 2011 Waterfowl Breeding Population and Habitat Survey, as judged by U.S. Fish and Wildlife Service Flyway Biologists.

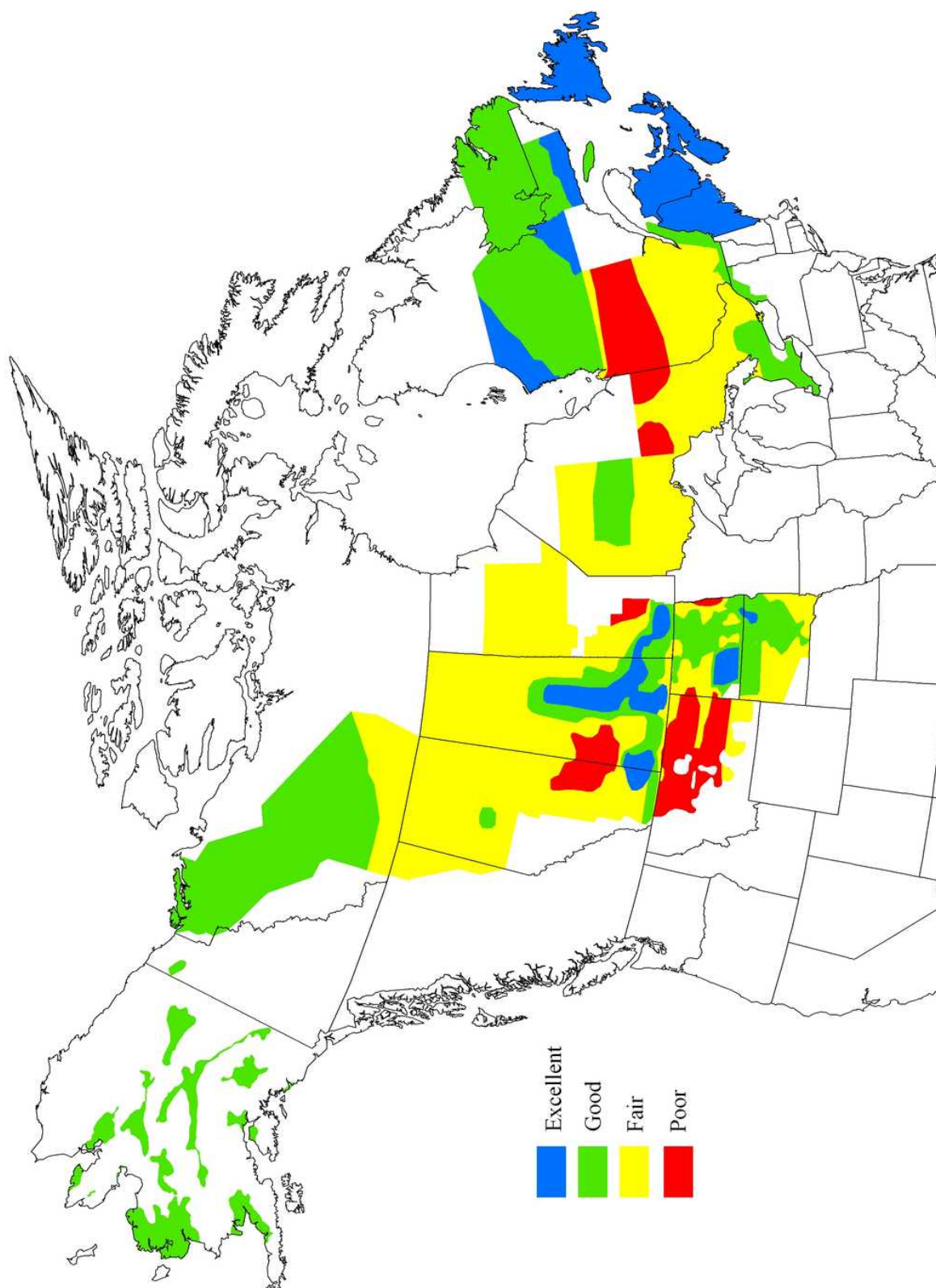


Figure 4: Breeding waterfowl habitat conditions during the 2010 Waterfowl Breeding Population and Habitat Survey, as judged by U.S. Fish and Wildlife Service Flyway Biologists.

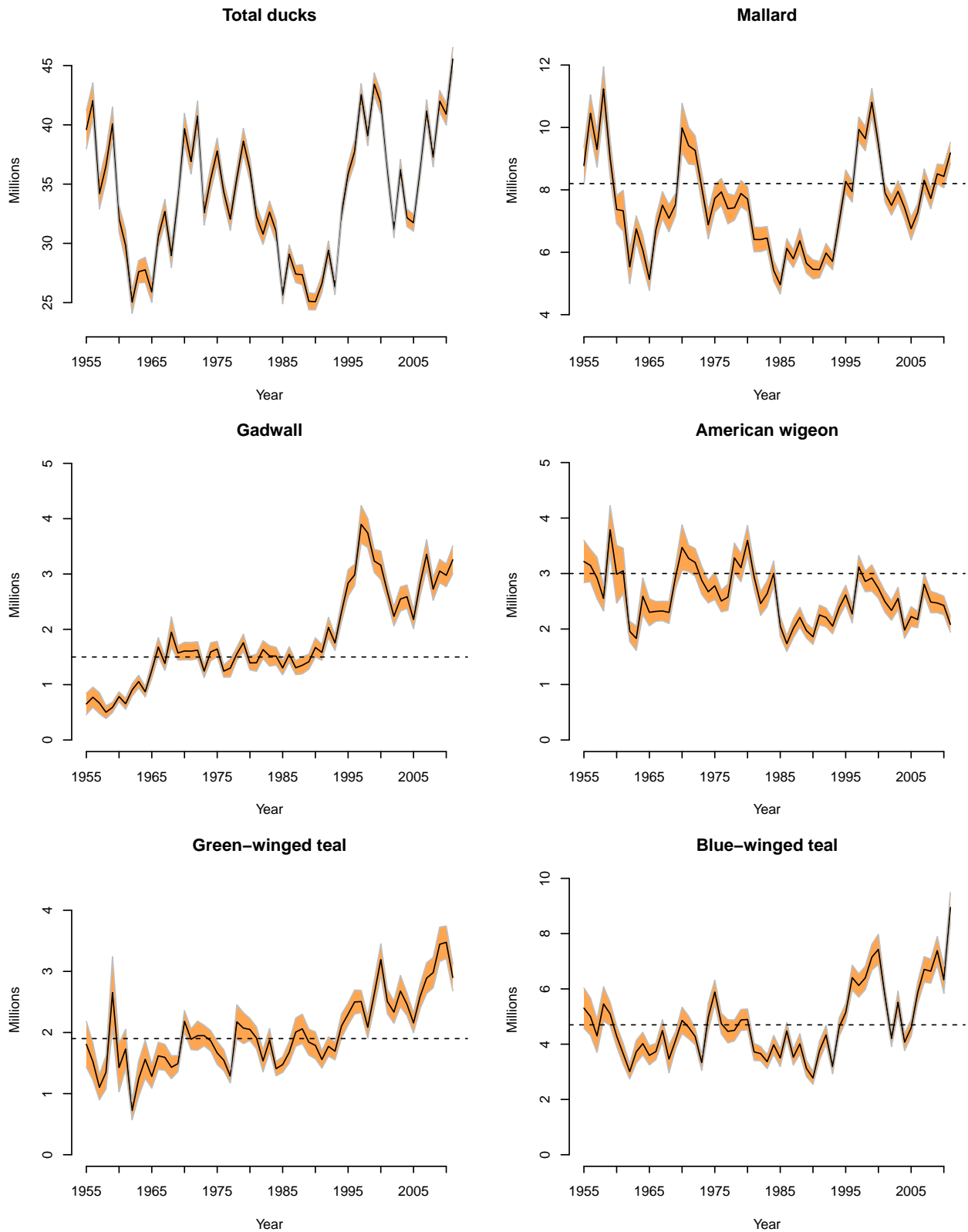


Figure 5: Breeding population estimates, 95% confidence intervals, and North American Waterfowl Management Plan population goal (dashed line) for selected species in the traditional survey area (strata 1–18, 20–50, 75–77).

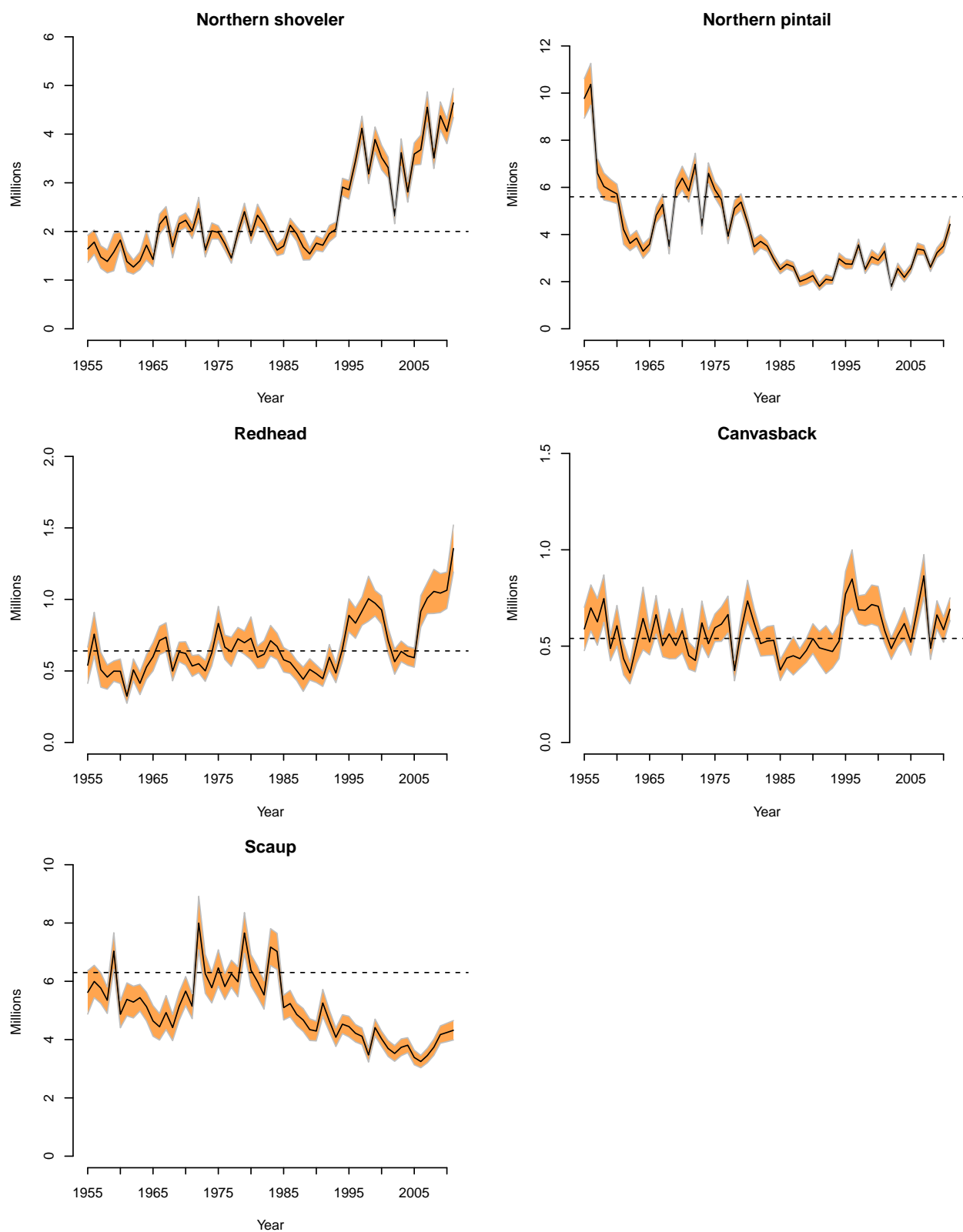


Figure 5: Continued.

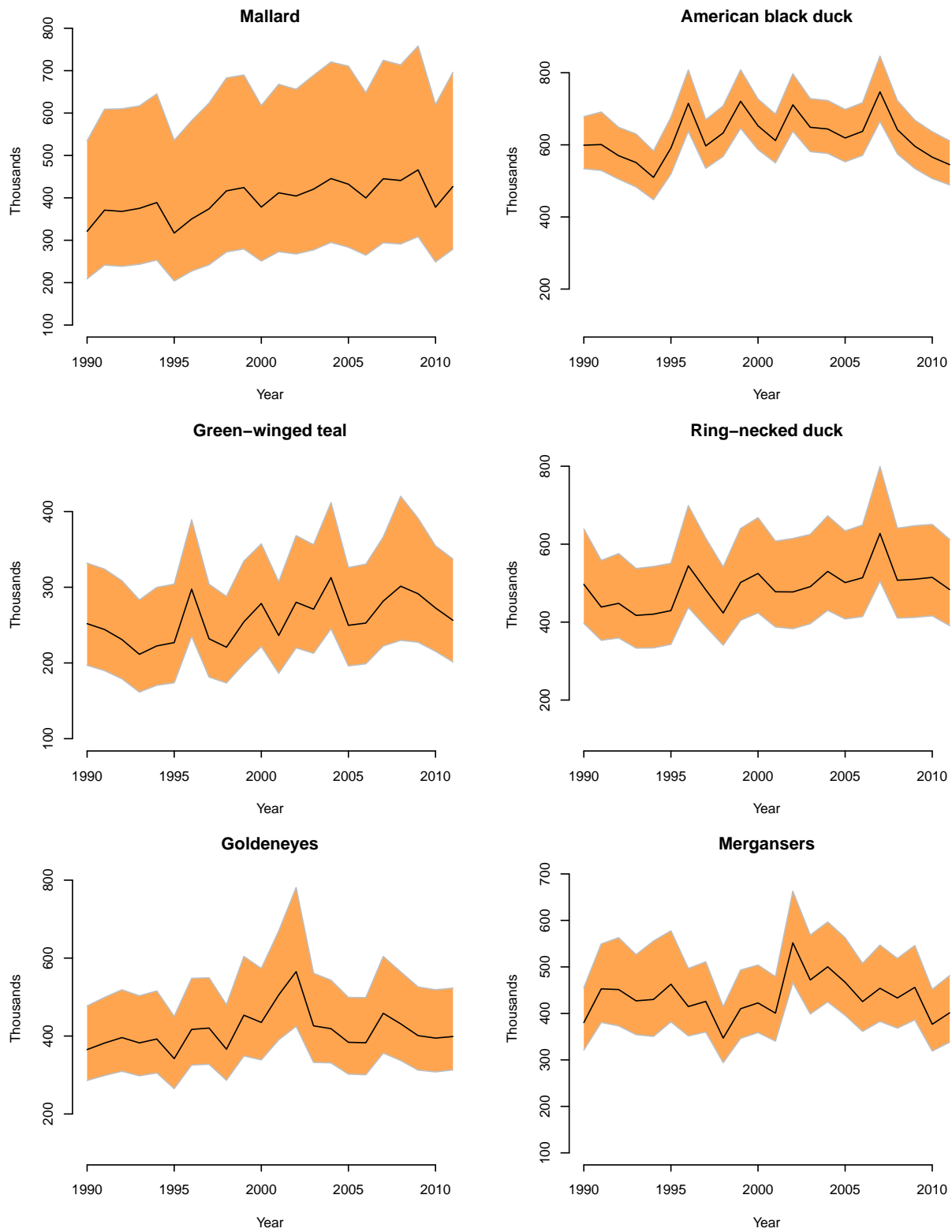


Figure 6: Breeding population estimates and 90% credibility intervals for selected species in the eastern survey area (strata 51, 52, 63, 64, 66–68, 70–72).

Appendix A: Breeding population estimates and standard errors (in thousands) for 10 species of ducks from the traditional survey area (strata 1–18, 20–50, 75–77).

Year	Mallard		Gadwall		American wigeon		Green-winged teal		Blue-winged teal	
	\hat{N}	\widehat{SE}	\hat{N}	\widehat{SE}	\hat{N}	\widehat{SE}	\hat{N}	\widehat{SE}	\hat{N}	\widehat{SE}
1955	8,777.3	457.1	651.5	149.5	3,216.8	297.8	1,807.2	291.5	5,305.2	567.6
1956	10,452.7	461.8	772.6	142.4	3,145.0	227.8	1,525.3	236.2	4,997.6	527.6
1957	9,296.9	443.5	666.8	148.2	2,919.8	291.5	1,102.9	161.2	4,299.5	467.3
1958	11,234.2	555.6	502.0	89.6	2,551.7	177.9	1,347.4	212.2	5,456.6	483.7
1959	9,024.3	466.6	590.0	72.7	3,787.7	339.2	2,653.4	459.3	5,099.3	332.7
1960	7,371.7	354.1	784.1	68.4	2,987.6	407.0	1,426.9	311.0	4,293.0	294.3
1961	7,330.0	510.5	654.8	77.5	3,048.3	319.9	1,729.3	251.5	3,655.3	298.7
1962	5,535.9	426.9	905.1	87.0	1,958.7	145.4	722.9	117.6	3,011.1	209.8
1963	6,748.8	326.8	1,055.3	89.5	1,830.8	169.9	1,242.3	226.9	3,723.6	323.0
1964	6,063.9	385.3	873.4	73.7	2,589.6	259.7	1,561.3	244.7	4,020.6	320.4
1965	5,131.7	274.8	1,260.3	114.8	2,301.1	189.4	1,282.0	151.0	3,594.5	270.4
1966	6,731.9	311.4	1,680.4	132.4	2,318.4	139.2	1,617.3	173.6	3,733.2	233.6
1967	7,509.5	338.2	1,384.6	97.8	2,325.5	136.2	1,593.7	165.7	4,491.5	305.7
1968	7,089.2	340.8	1,949.0	213.9	2,298.6	156.1	1,430.9	146.6	3,462.5	389.1
1969	7,531.6	280.2	1,573.4	100.2	2,941.4	168.6	1,491.0	103.5	4,138.6	239.5
1970	9,985.9	617.2	1,608.1	123.5	3,469.9	318.5	2,182.5	137.7	4,861.8	372.3
1971	9,416.4	459.5	1,605.6	123.0	3,272.9	186.2	1,889.3	132.9	4,610.2	322.8
1972	9,265.5	363.9	1,622.9	120.1	3,200.1	194.1	1,948.2	185.8	4,278.5	230.5
1973	8,079.2	377.5	1,245.6	90.3	2,877.9	197.4	1,949.2	131.9	3,332.5	220.3
1974	6,880.2	351.8	1,592.4	128.2	2,672.0	159.3	1,864.5	131.2	4,976.2	394.6
1975	7,726.9	344.1	1,643.9	109.0	2,778.3	192.0	1,664.8	148.1	5,885.4	337.4
1976	7,933.6	337.4	1,244.8	85.7	2,505.2	152.7	1,547.5	134.0	4,744.7	294.5
1977	7,397.1	381.8	1,299.0	126.4	2,575.1	185.9	1,285.8	87.9	4,462.8	328.4
1978	7,425.0	307.0	1,558.0	92.2	3,282.4	208.0	2,174.2	219.1	4,498.6	293.3
1979	7,883.4	327.0	1,757.9	121.0	3,106.5	198.2	2,071.7	198.5	4,875.9	297.6
1980	7,706.5	307.2	1,392.9	98.8	3,595.5	213.2	2,049.9	140.7	4,895.1	295.6
1981	6,409.7	308.4	1,395.4	120.0	2,946.0	173.0	1,910.5	141.7	3,720.6	242.1
1982	6,408.5	302.2	1,633.8	126.2	2,458.7	167.3	1,535.7	140.2	3,657.6	203.7
1983	6,456.0	286.9	1,519.2	144.3	2,636.2	181.4	1,875.0	148.0	3,366.5	197.2
1984	5,415.3	258.4	1,515.0	125.0	3,002.2	174.2	1,408.2	91.5	3,979.3	267.6
1985	4,960.9	234.7	1,303.0	98.2	2,050.7	143.7	1,475.4	100.3	3,502.4	246.3
1986	6,124.2	241.6	1,547.1	107.5	1,736.5	109.9	1,674.9	136.1	4,478.8	237.1
1987	5,789.8	217.9	1,305.6	97.1	2,012.5	134.3	2,006.2	180.4	3,528.7	220.2
1988	6,369.3	310.3	1,349.9	121.1	2,211.1	139.1	2,060.8	188.3	4,011.1	290.4
1989	5,645.4	244.1	1,414.6	106.6	1,972.9	106.0	1,841.7	166.4	3,125.3	229.8

Appendix A: Continued.

Year	Mallard		Gadwall		American wigeon		Green-winged teal		Blue-winged teal	
	\hat{N}	\widehat{SE}	\hat{N}	\widehat{SE}	\hat{N}	\widehat{SE}	\hat{N}	\widehat{SE}	\hat{N}	\widehat{SE}
1990	5,452.4	238.6	1,672.1	135.8	1,860.1	108.3	1,789.5	172.7	2,776.4	178.7
1991	5,444.6	205.6	1,583.7	111.8	2,254.0	139.5	1,557.8	111.3	3,763.7	270.8
1992	5,976.1	241.0	2,032.8	143.4	2,208.4	131.9	1,773.1	123.7	4,333.1	263.2
1993	5,708.3	208.9	1,755.2	107.9	2,053.0	109.3	1,694.5	112.7	3,192.9	205.6
1994	6,980.1	282.8	2,318.3	145.2	2,382.2	130.3	2,108.4	152.2	4,616.2	259.2
1995	8,269.4	287.5	2,835.7	187.5	2,614.5	136.3	2,300.6	140.3	5,140.0	253.3
1996	7,941.3	262.9	2,984.0	152.5	2,271.7	125.4	2,499.5	153.4	6,407.4	353.9
1997	9,939.7	308.5	3,897.2	264.9	3,117.6	161.6	2,506.6	142.5	6,124.3	330.7
1998	9,640.4	301.6	3,742.2	205.6	2,857.7	145.3	2,087.3	138.9	6,398.8	332.3
1999	10,805.7	344.5	3,235.5	163.8	2,920.1	185.5	2,631.0	174.6	7,149.5	364.5
2000	9,470.2	290.2	3,158.4	200.7	2,733.1	138.8	3,193.5	200.1	7,431.4	425.0
2001	7,904.0	226.9	2,679.2	136.1	2,493.5	149.6	2,508.7	156.4	5,757.0	288.8
2002	7,503.7	246.5	2,235.4	135.4	2,334.4	137.9	2,333.5	143.8	4,206.5	227.9
2003	7,949.7	267.3	2,549.0	169.9	2,551.4	156.9	2,678.5	199.7	5,518.2	312.7
2004	7,425.3	282.0	2,589.6	165.6	1,981.3	114.9	2,460.8	145.2	4,073.0	238.0
2005	6,755.3	280.8	2,179.1	131.0	2,225.1	139.2	2,156.9	125.8	4,585.5	236.3
2006	7,276.5	223.7	2,824.7	174.2	2,171.2	115.7	2,587.2	155.3	5,859.6	303.5
2007	8,307.3	285.8	3,355.9	206.2	2,806.8	152.0	2,890.3	196.1	6,707.6	362.2
2008	7,723.8	256.8	2,727.7	158.9	2,486.6	151.3	2,979.7	194.4	6,640.1	337.3
2009	8,512.4	248.3	3,053.5	166.3	2,468.6	135.4	3,443.6	219.9	7,383.8	396.8
2010	8,430.1	284.9	2,976.7	161.6	2,424.6	131.5	3,475.9	207.2	6,328.5	382.6
2011	9,182.6	267.8	3,256.9	196.9	2,084.0	110.1	2,900.1	170.7	8,948.5	418.2

Appendix A: Continued.

Year	Northern shoveler		Northern pintail		Redhead		Canvasback		Scaup	
	\hat{N}	\widehat{SE}	\hat{N}	\widehat{SE}	\hat{N}	\widehat{SE}	\hat{N}	\widehat{SE}	\hat{N}	\widehat{SE}
1955	1,642.8	218.7	9,775.1	656.1	539.9	98.9	589.3	87.8	5,620.1	582.1
1956	1,781.4	196.4	10,372.8	694.4	757.3	119.3	698.5	93.3	5,994.1	434.0
1957	1,476.1	181.8	6,606.9	493.4	509.1	95.7	626.1	94.7	5,766.9	411.7
1958	1,383.8	185.1	6,037.9	447.9	457.1	66.2	746.8	96.1	5,350.4	355.1
1959	1,577.6	301.1	5,872.7	371.6	498.8	55.5	488.7	50.6	7,037.6	492.3
1960	1,824.5	130.1	5,722.2	323.2	497.8	67.0	605.7	82.4	4,868.6	362.5
1961	1,383.0	166.5	4,218.2	496.2	323.3	38.8	435.3	65.7	5,380.0	442.2
1962	1,269.0	113.9	3,623.5	243.1	507.5	60.0	360.2	43.8	5,286.1	426.4
1963	1,398.4	143.8	3,846.0	255.6	413.4	61.9	506.2	74.9	5,438.4	357.9
1964	1,718.3	240.3	3,291.2	239.4	528.1	67.3	643.6	126.9	5,131.8	386.1
1965	1,423.7	114.1	3,591.9	221.9	599.3	77.7	522.1	52.8	4,640.0	411.2
1966	2,147.0	163.9	4,811.9	265.6	713.1	77.6	663.1	78.0	4,439.2	356.2
1967	2,314.7	154.6	5,277.7	341.9	735.7	79.0	502.6	45.4	4,927.7	456.1
1968	1,684.5	176.8	3,489.4	244.6	499.4	53.6	563.7	101.3	4,412.7	351.8
1969	2,156.8	117.2	5,903.9	296.2	633.2	53.6	503.5	53.7	5,139.8	378.5
1970	2,230.4	117.4	6,392.0	396.7	622.3	64.3	580.1	90.4	5,662.5	391.4
1971	2,011.4	122.7	5,847.2	368.1	534.4	57.0	450.7	55.2	5,143.3	333.8
1972	2,466.5	182.8	6,979.0	364.5	550.9	49.4	425.9	46.0	7,997.0	718.0
1973	1,619.0	112.2	4,356.2	267.0	500.8	57.7	620.5	89.1	6,257.4	523.1
1974	2,011.3	129.9	6,598.2	345.8	626.3	70.8	512.8	56.8	5,780.5	409.8
1975	1,980.8	106.7	5,900.4	267.3	831.9	93.5	595.1	56.1	6,460.0	486.0
1976	1,748.1	106.9	5,475.6	299.2	665.9	66.3	614.4	70.1	5,818.7	348.7
1977	1,451.8	82.1	3,926.1	246.8	634.0	79.9	664.0	74.9	6,260.2	362.8
1978	1,975.3	115.6	5,108.2	267.8	724.6	62.2	373.2	41.5	5,984.4	403.0
1979	2,406.5	135.6	5,376.1	274.4	697.5	63.8	582.0	59.8	7,657.9	548.6
1980	1,908.2	119.9	4,508.1	228.6	728.4	116.7	734.6	83.8	6,381.7	421.2
1981	2,333.6	177.4	3,479.5	260.5	594.9	62.0	620.8	59.1	5,990.9	414.2
1982	2,147.6	121.7	3,708.8	226.6	616.9	74.2	513.3	50.9	5,532.0	380.9
1983	1,875.7	105.3	3,510.6	178.1	711.9	83.3	526.6	58.9	7,173.8	494.9
1984	1,618.2	91.9	2,964.8	166.8	671.3	72.0	530.1	60.1	7,024.3	484.7
1985	1,702.1	125.7	2,515.5	143.0	578.2	67.1	375.9	42.9	5,098.0	333.1
1986	2,128.2	112.0	2,739.7	152.1	559.6	60.5	438.3	41.5	5,235.3	355.5
1987	1,950.2	118.4	2,628.3	159.4	502.4	54.9	450.1	77.9	4,862.7	303.8
1988	1,680.9	210.4	2,005.5	164.0	441.9	66.2	435.0	40.2	4,671.4	309.5
1989	1,538.3	95.9	2,111.9	181.3	510.7	58.5	477.4	48.4	4,342.1	291.3
1990	1,759.3	118.6	2,256.6	183.3	480.9	48.2	539.3	60.3	4,293.1	264.9

Appendix A: Continued.

Year	Northern shoveler		Northern pintail		Redhead		Canvasback		Scaup	
	\hat{N}	\widehat{SE}	\hat{N}	\widehat{SE}	\hat{N}	\widehat{SE}	\hat{N}	\widehat{SE}	\hat{N}	\widehat{SE}
1991	1,716.2	104.6	1,803.4	131.3	445.6	42.1	491.2	66.4	5,254.9	364.9
1992	1,954.4	132.1	2,098.1	161.0	595.6	69.7	481.5	97.3	4,639.2	291.9
1993	2,046.5	114.3	2,053.4	124.2	485.4	53.1	472.1	67.6	4,080.1	249.4
1994	2,912.0	141.4	2,972.3	188.0	653.5	66.7	525.6	71.1	4,529.0	253.6
1995	2,854.9	150.3	2,757.9	177.6	888.5	90.6	770.6	92.2	4,446.4	277.6
1996	3,449.0	165.7	2,735.9	147.5	834.2	83.1	848.5	118.3	4,217.4	234.5
1997	4,120.4	194.0	3,558.0	194.2	918.3	77.2	688.8	57.2	4,112.3	224.2
1998	3,183.2	156.5	2,520.6	136.8	1,005.1	122.9	685.9	63.8	3,471.9	191.2
1999	3,889.5	202.1	3,057.9	230.5	973.4	69.5	716.0	79.1	4,411.7	227.9
2000	3,520.7	197.9	2,907.6	170.5	926.3	78.1	706.8	81.0	4,026.3	205.3
2001	3,313.5	166.8	3,296.0	266.6	712.0	70.2	579.8	52.7	3,694.0	214.9
2002	2,318.2	125.6	1,789.7	125.2	564.8	69.0	486.6	43.8	3,524.1	210.3
2003	3,619.6	221.4	2,558.2	174.8	636.8	56.6	557.6	48.0	3,734.4	225.5
2004	2,810.4	163.9	2,184.6	155.2	605.3	51.5	617.2	64.6	3,807.2	202.3
2005	3,591.5	178.6	2,560.5	146.8	592.3	51.7	520.6	52.9	3,386.9	196.4
2006	3,680.2	236.5	3,386.4	198.7	916.3	86.1	691.0	69.6	3,246.7	166.9
2007	4,552.8	247.5	3,335.3	160.4	1,009.0	84.7	864.9	86.2	3,452.2	195.3
2008	3,507.8	168.4	2,612.8	143.0	1,056.0	120.4	488.7	45.4	3,738.3	220.1
2009	4,376.3	224.1	3,225.0	166.9	1,044.1	106.3	662.1	57.4	4,172.1	232.3
2010	4,057.4	198.4	3,508.6	216.4	1,064.2	99.5	585.2	50.8	4,244.4	247.9
2011	4,641.0	232.8	4,428.6	267.9	1,356.1	128.3	691.6	46.0	4,319.3	261.1

Appendix B: Breeding population estimates and 90% confidence intervals or credibility intervals (in thousands) for the 6 most abundant species of ducks in the eastern survey area, 1990–2011^a.

Year	Mallard		American black duck		Green-winged teal		Ring-necked duck		Goldeneyes ^b		Mergansers ^c	
	\hat{N}	90% CI	\hat{N}	90% CI	\hat{N}	90% CI	\hat{N}	90% CI	\hat{N}	90% CI	\hat{N}	90% CI
1990	321.0	(209.2, 534.3)	599.0	(533.8, 678.2)	251.9	(196.9, 331.8)	496.9	(396.9, 639.1)	365.2	(286.0, 477.0)	380.2	(321.3, 455.0)
1991	371.0	(241.5, 608.9)	600.8	(529.0, 691.0)	244.2	(189.9, 324.0)	438.7	(353.3, 558.2)	382.0	(298.7, 499.1)	452.8	(380.6, 549.4)
1992	368.0	(238.6, 610.0)	569.8	(505.0, 648.5)	230.9	(179.1, 308.5)	448.1	(359.4, 575.8)	396.0	(309.7, 518.7)	451.3	(373.2, 562.8)
1993	375.2	(243.3, 616.7)	550.9	(483.3, 630.1)	211.4	(161.5, 283.2)	417.2	(333.4, 537.5)	382.4	(298.0, 503.2)	427.0	(354.3, 526.4)
1994	388.9	(253.3, 645.2)	509.7	(447.8, 582.9)	222.5	(170.5, 299.8)	420.4	(333.9, 542.7)	392.4	(305.3, 515.7)	430.0	(350.5, 555.6)
1995	317.0	(203.9, 535.5)	591.1	(519.1, 676.0)	226.9	(173.8, 304.1)	429.5	(343.0, 550.8)	342.0	(265.0, 450.3)	462.8	(381.9, 577.6)
1996	350.2	(227.3, 582.0)	714.9	(637.7, 807.6)	297.5	(235.3, 389.1)	544.4	(438.0, 698.7)	417.0	(325.6, 547.9)	414.8	(351.5, 496.6)
1997	374.1	(242.1, 623.4)	597.0	(535.0, 669.5)	231.9	(181.4, 304.0)	482.9	(388.5, 615.3)	420.5	(327.6, 549.6)	425.8	(360.0, 510.9)
1998	416.5	(272.4, 682.8)	633.0	(568.0, 708.0)	220.8	(173.6, 287.9)	423.4	(340.8, 541.4)	366.1	(286.5, 480.2)	346.8	(294.0, 414.4)
1999	424.3	(279.5, 689.7)	720.8	(645.9, 808.0)	254.3	(198.9, 334.5)	501.8	(404.6, 640.2)	453.5	(349.0, 604.2)	410.1	(346.3, 493.3)
2000	378.2	(251.0, 617.6)	652.7	(586.9, 727.0)	278.6	(221.7, 357.3)	524.8	(423.7, 668.0)	434.9	(338.9, 573.4)	422.5	(358.8, 504.0)
2001	411.8	(273.1, 667.7)	612.0	(550.1, 685.0)	236.3	(186.4, 307.0)	477.8	(387.6, 607.7)	505.5	(390.3, 669.3)	400.6	(340.4, 479.1)
2002	404.4	(267.7, 656.0)	711.0	(637.8, 797.0)	280.2	(220.0, 368.2)	477.4	(383.0, 614.6)	565.3	(425.0, 781.0)	551.8	(466.0, 662.7)
2003	420.5	(277.3, 689.0)	648.6	(581.1, 728.0)	271.0	(212.8, 356.2)	490.9	(395.9, 625.0)	426.1	(332.4, 561.0)	471.9	(398.9, 568.5)
2004	445.5	(295.0, 720.4)	644.0	(576.3, 722.9)	312.8	(245.2, 411.7)	530.1	(430.2, 672.7)	418.9	(331.1, 543.3)	500.2	(424.8, 596.7)
2005	432.2	(283.6, 710.6)	619.0	(553.0, 698.0)	249.7	(196.1, 326.0)	501.4	(408.1, 633.8)	383.9	(302.3, 499.0)	467.0	(396.0, 562.8)
2006	399.8	(264.9, 648.1)	637.4	(570.9, 716.7)	252.7	(198.9, 330.5)	513.8	(414.2, 649.0)	382.8	(300.7, 498.6)	425.4	(361.5, 507.5)
2007	445.0	(294.1, 724.4)	747.0	(664.9, 846.2)	281.7	(222.4, 366.3)	627.4	(505.0, 798.9)	458.4	(356.4, 604.2)	454.0	(382.9, 546.9)
2008	441.0	(291.3, 713.6)	642.1	(575.0, 722.6)	301.4	(229.9, 420.2)	507.3	(410.4, 640.9)	431.3	(337.3, 564.8)	433.2	(368.3, 518.1)
2009	466.0	(308.5, 758.0)	596.2	(534.4, 668.4)	291.4	(227.4, 391.0)	510.0	(412.1, 647.3)	401.0	(312.5, 525.9)	456.0	(386.1, 546.0)
2010	377.9	(249.0, 620.0)	565.9	(506.7, 636.4)	272.6	(215.4, 354.7)	514.8	(416.2, 650.6)	394.7	(308.0, 518.7)	376.7	(319.0, 451.7)
2011	426.8	(279.0, 696.0)	545.0	(489.0, 611.0)	256.3	(201.4, 337.3)	483.5	(390.9, 612.0)	398.7	(313.1, 522.9)	401.2	(338.2, 481.3)

^a Estimates for from Bayesian hierarchical analysis using FWS and CWS data from strata 51, 52, 63, 64, 66–68, 70–72.

^b Common and Barrow's.

^c Common, red-breasted, and hooded.

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